



## CONSULTANTS GROUP

GEOLOGY

ENGINEERING

ENVIRONMENT

HYDROLOGY

September 22, 1986

Mr. Richard B. Hall  
Directing Dam Safety Engineer  
Division of Water Rights  
1636 West North Temple  
Salt Lake City, Utah 84116-3156

**RECEIVED**  
SEP 24 1986

**DIVISION OF  
OIL, GAS & MINING**

Dear Mr. Hall:

This letter is in response to your July 9, 1986 comment letter regarding the Barrick Mercur Gold Mines, Inc., Meadow Canyon Dam.

1. We have retested the mine waste proposed for the construction material of the dam. This testing was conducted at the University of Arizona Geomechanics Lab. Three drum-sized, representative samples were obtained of the following materials: barren limestone which contains the least amount of shale, upper beds which are interbedded limestones, and shales, and waste dump material from the existing Mercur Hill Pit which represents a somewhat homogenous mixture of all waste material types that might be encountered in the Marion Hill Pit.

The UA lab conducted the following tests for which lab reports are attached:

- a) Standard Proctor test, ASTM 698.
- b) Direct shear, under drained conditions, of material compacted to at least 90% of the maximum dry density and at the optimum moisture content in a 12-inch shear box. This enabled us to test the strenght of the materials with a larger percentage of coarse material than is normally possible with a soil testing shear box. We feel that this provides a more accurate assessment of the true strengths of these rocky materials.

The friction angle values for the three materials varied from 36 to 38 degrees with a mean of 37 degrees. These values compare favorably with the friction angle of 32 degrees which was used in the stability analyses previously submitted to your office and which were used for the dam design. The cohesion values for the three materials tested by the UA lab ranged from 648 psf to 1368 psf with a mean of 1104 psf. These values are significantly higher than the cohesion value of 100 psf which was used in the aforementioned stability analyses.

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R. Hall Letter  
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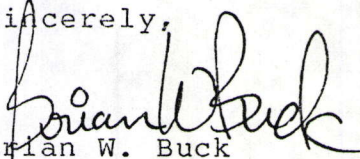
Because these strength values are larger than the conservative values used in the design of the dam we recommend that this documentation be acceptable for your approval of the design.

2. Drawing No. 5 of the plans has been revised to include a stage-discharge curve for the spillway inlet. A print of this revised drawing is included with this letter.

3. The detail drawing of the keyway has been revised to allow some flexibility on the depth of the keyway when rock is encountered. A print of this drawing is included with this letter.

We trust that these additions to the application will satisfy your needs as stated in your July 9th letter. Please call if you have any further questions.

Sincerely,



Brian W. Buck

enclosures

cc. G. Eurick, Barrick  
J. McDonough, Barrick  
L. Braxton, DOGM

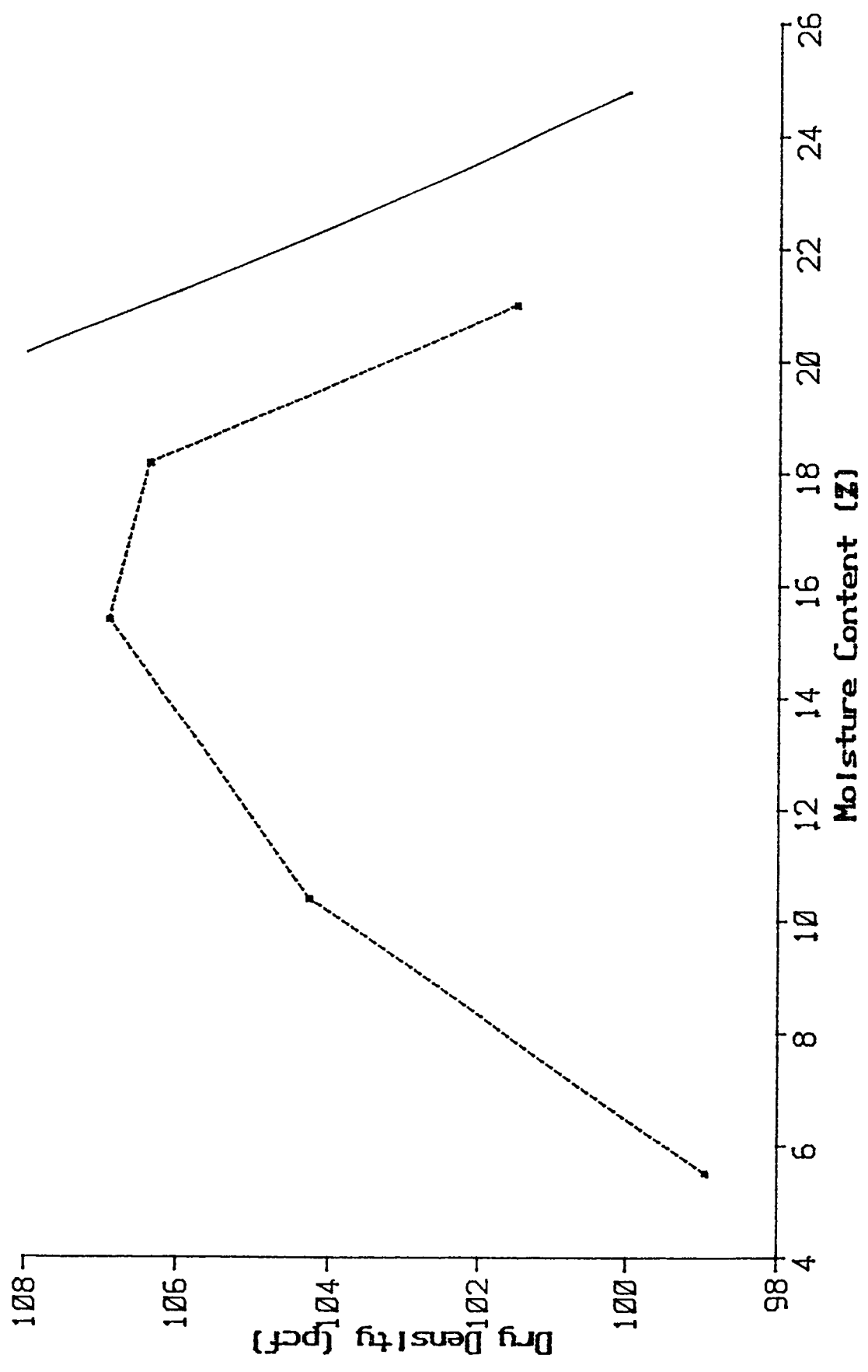


# Standard Procter Test

Job: Mercur Method Used: A  
 Sample: Barren Limestone Optimum Moisture Content: 16%  
 Date: 8/19/86 Maximum Density (pcf): 107 pcf  
 By: Armstrong

Test	Weight of mold (g)	Weight of mold + soil (g)	Weight of soil (g)	Wet Density (pcf)	Moisture Content (%)	Dry Density (pcf)
1	4199	5779	1580	104.4053	5.5	98.96236
2	4199	5941	1742	115.1101	10.4	104.2664
3	4199	6066	1867	123.3700	15.4	106.9065
4	4199	6102	1903	125.7489	18.2	106.3865
5	4199	6058	1859	122.8414	21	101.5218

# Barren Limestone

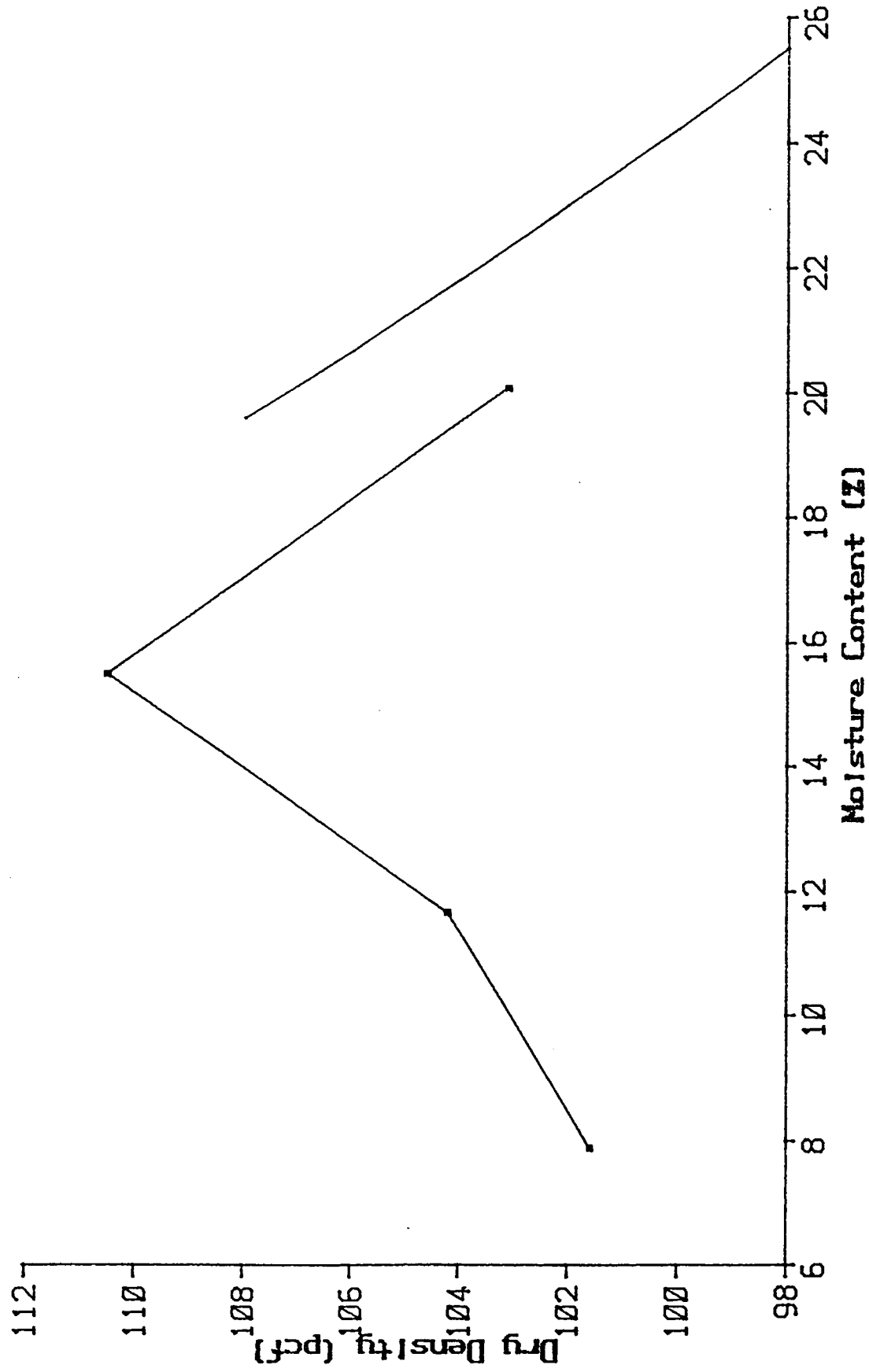


# Standard Proctor Test

Job:	Mercur	Method Used:	A
Sample:	Upper Beds	Optimum Moisture Content:	15.8 %
Date:	8/21/86	Maximum Density:	110.5 pfc
By:	Armstrong		

Test	Weight of mold (g)	Weight of mold + soil (g)	Weight of soil (g)	Wet Density (pcf)	Moisture Content (%)	Dry Density (pcf)
1	4199	5857.5	1658.5	109.5925	7.88	101.5874
2	4199	5960	1761	116.3656	11.66	104.2143
3	4199	6130.5	1931.5	127.6322	15.5	110.5040
4	4199	6073	1874	123.8326	20.09	103.1165

# Upper Beds

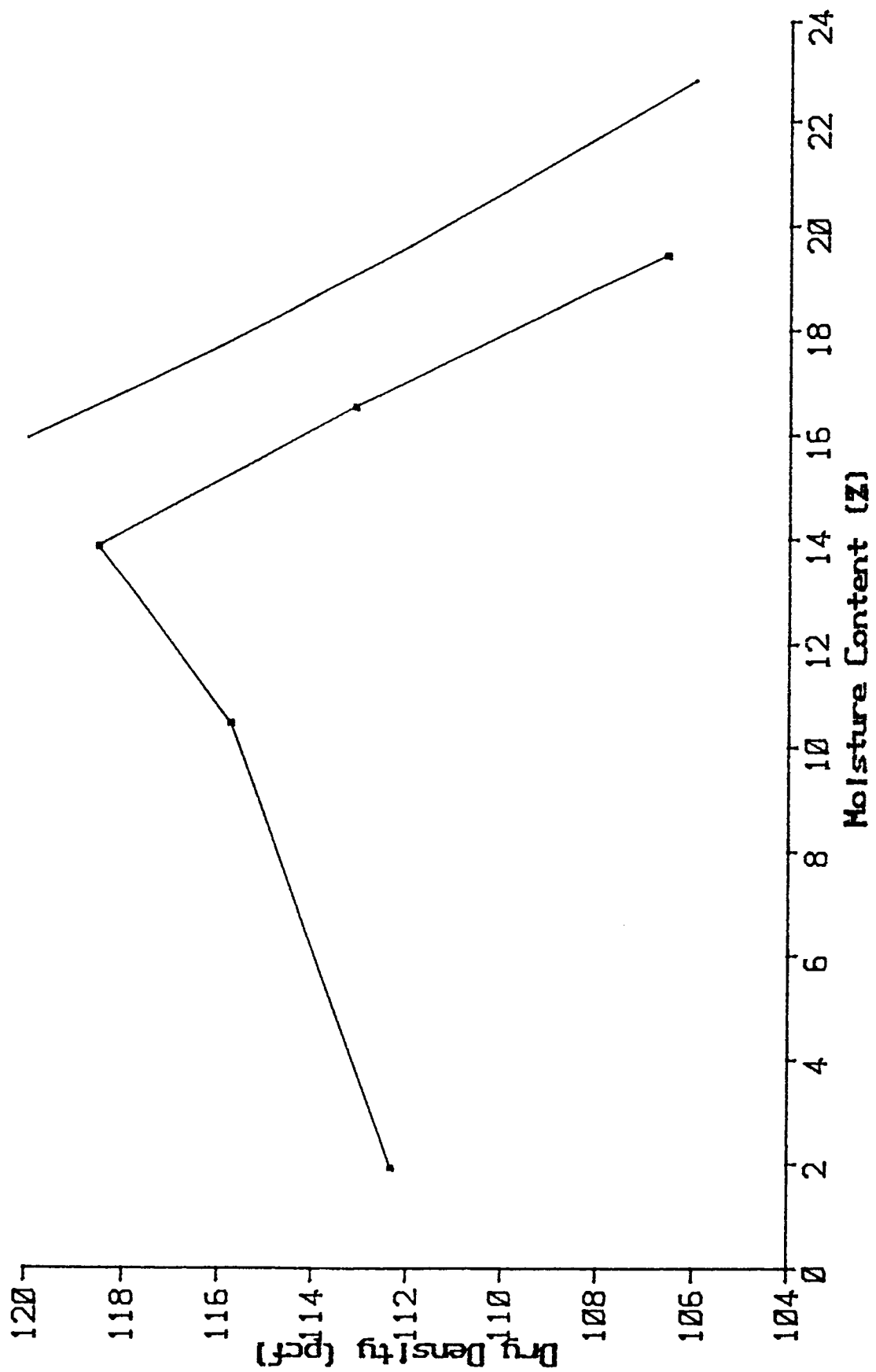


# Standard Proctor Test

Job:	Mercur	Method Used:	A
Sample:	Waste Dump	Optimum Moisture Content:	13.0%
Date:	8/27/86	Maximum Density:	118.9 pcf
By:	Miley		

Test	Weight of mold (g)	Weight of mold + soil (g)	Weight of soil (g)	Wet Density (pcf)	Moisture Content (%)	Dry Density (pcf)
1	4199	5932	1733	114.5154	1.95	112.3251
2	4199	6136	1937	127.9956	10.55	115.7807
3	4199	6243	2044	135.0661	13.95	118.5310
4	4199	6196	1997	131.9604	16.62	113.1541
5	4199	6127	1928	127.4009	19.54	106.5759

# Waste Dump





Test Name: Barren Limestone

Test Data

Normal Load (lbs)	Shear Load (lbs)	Sample Radius (in.)	Shear Length (in.)	Sample Width (in.)	Sample Area (in2.)	Sample Displacement (in.)	Breakage Correction (%)
1932.00	2530.00	0.000	711.75	711.75	123.96	71.20	
0							
3838.00	3823.00	0.000	711.75	711.75	122.79	71.30	
0							
5757.00	5283.00	0.000	711.75	711.75	123.96	71.20	
0							

Number of Data Points: 3

Test Results

Linear Data

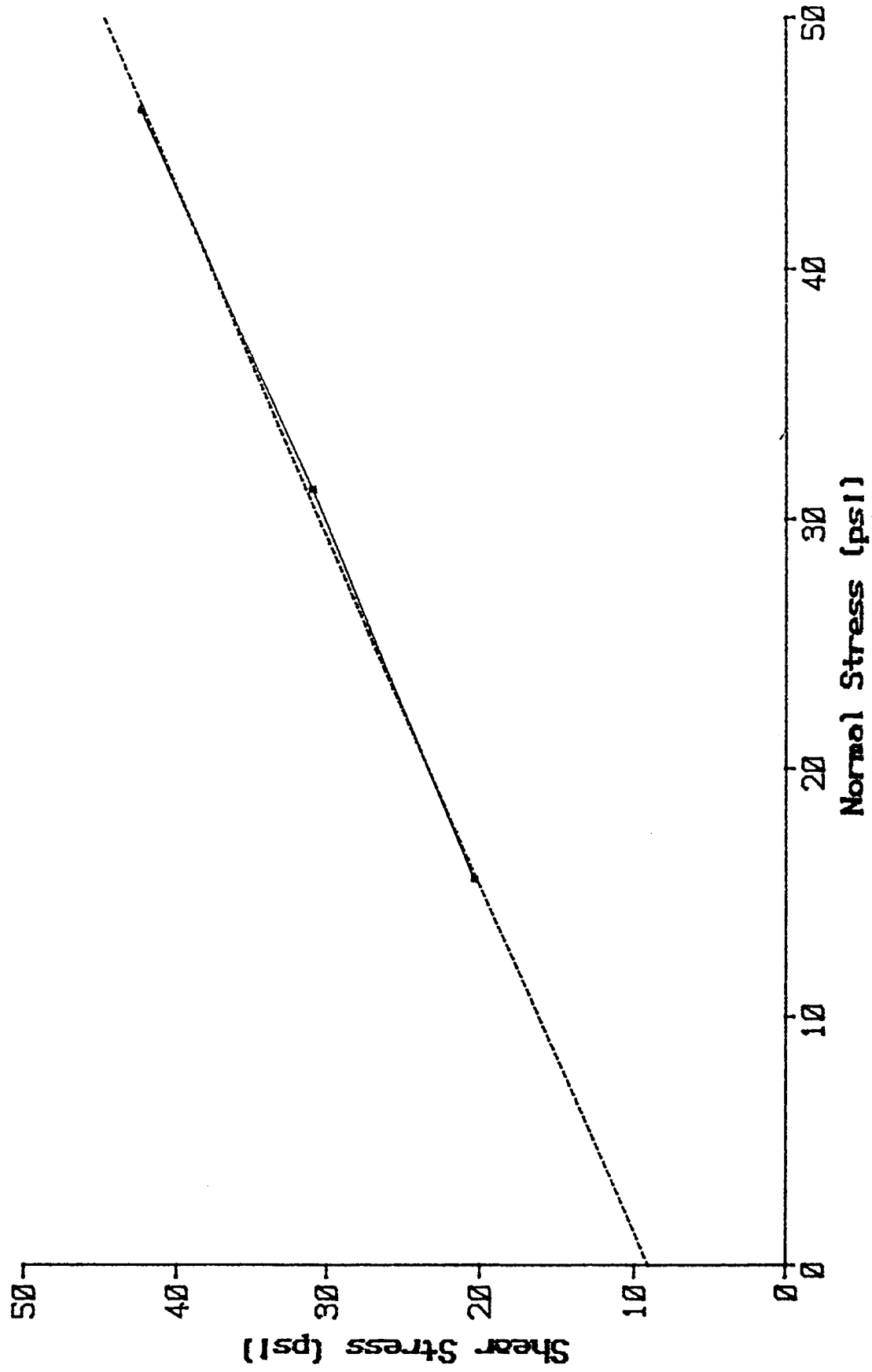
Effective Cohesion	9.0 psi
Angle of Sliding Friction	36 deg.
Mean Shear Stress	31.4 psi
Mean Normal Stress	31.1 psi
Equation of Regression Line	$y = 0.72x + 9.0$
Coefficient of Correlation	1.00
Coefficient of Determination	1.00

Power Data

Coefficient k	3.24
Exponent m	0.67

Run No.	Shear Stress	Normal Stress
1	20.4094	15.58536
2	31.13509	31.25725
3	42.61773	46.44147

# Barren Limestone



# AREA DATA & LOAD CALCULATIONS

Job: Mercur Initial Area: %138.06 SQ. IN.  
 Location: UT Date: 8/20/86  
 Sample Number: Barren Limestone By: Armstrong

SAMPLE WIDTH	SAMPLE LENGTH	AREA IN SQ. INCHES
11.75	11.75	138.

Normal Stress (psi)	Area (insq)	Load on Sample (lbs) Cal.	PSIG App.
13.89	%138.06	1918	1932
27.78	%138.06	3835	3838
41.67	%138.06	5753	5757



Test Name: Upper Beds

Test Data

Normal Load (lbs)	Shear Load (lbs)	Sample Radius (in.)	Shear Length (in.)	Sample Width (in.)	Sample Area (in2.)	Sample Displacement (in.)	Breakage Correction (%)
1932.00	2640.00	0.000	11.75	11.75	122.79	1.30	
0							
3838.00	4261.00	0.000	11.75	11.75	123.38	1.25	
0							
5757.00	5640.00	0.000	11.75	11.75	123.38	1.25	
0							

Number of Data Points: 3

Test Results

Linear Data

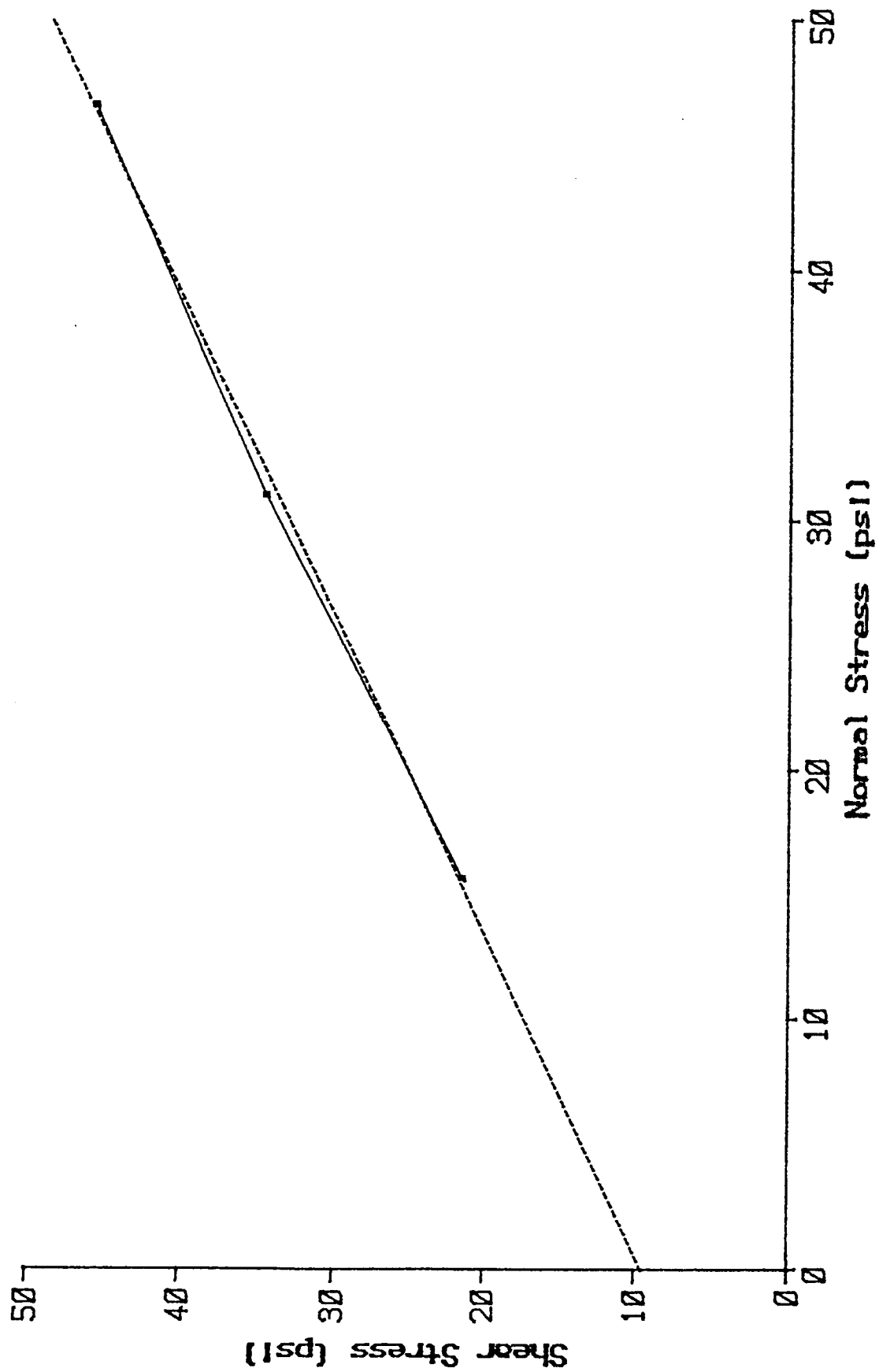
Effective Cohesion	9.5 psi
Angle of Sliding Friction	38 deg.
Mean Shear Stress	33.9 psi
Mean Normal Stress	31.2 psi
Equation of Regression Line	$y = 0.78x + 9.5$
Coefficient of Correlation	1.00
Coefficient of Determination	1.00

Power Data

Coefficient k	3.18
Exponent m	0.69

Run No.	Shear Stress	Normal Stress
1	21.50056	15.7345
2	34.53698	31.10841
3	45.71429	46.66262

# Upper Beds



# AREA DATA & LOAD CALCULATIONS

Job: Mercur  
 Location: UT  
 Sample Number: Upper Beds

Initial Area: %138.06 SQ. IN.  
 Date: 8/25/86  
 By: Armstrong

SAMPLE WIDTH	SAMPLE LENGTH	AREA IN SQ. INCHES
11.75	11.75	138.

Normal Stress (psi)	Area (insq)	Load on Sample (lbs) Cal.	PSIG App.
13.89	%138.06	1918	475
27.78	%138.06	3835	950
41.67	%138.06	5753	1425



Test Name: Waste Dump

Test Data

Normal Load (lbs)	Shear Load (lbs)	Sample Radius (in.)	Shear Length (in.)	Sample Width (in.)	Sample Area (in2.)	Sample Displacement (in.)	Breakage Correction (%)
1932.00	1715.00	0.000	%11.75	%11.75	129.84	.70	0
3838.00	3054.00	0.000	%11.75	%11.75	126.08	%1.02	
0							
5757.00	5096.00	0.000	%11.75	%11.75	123.96	%1.20	
0							
960.00	1630.00	0.000	%11.75	%11.75	120.67	%1.48	
0							

Number of Data Points: 4

Test Results

Linear Data

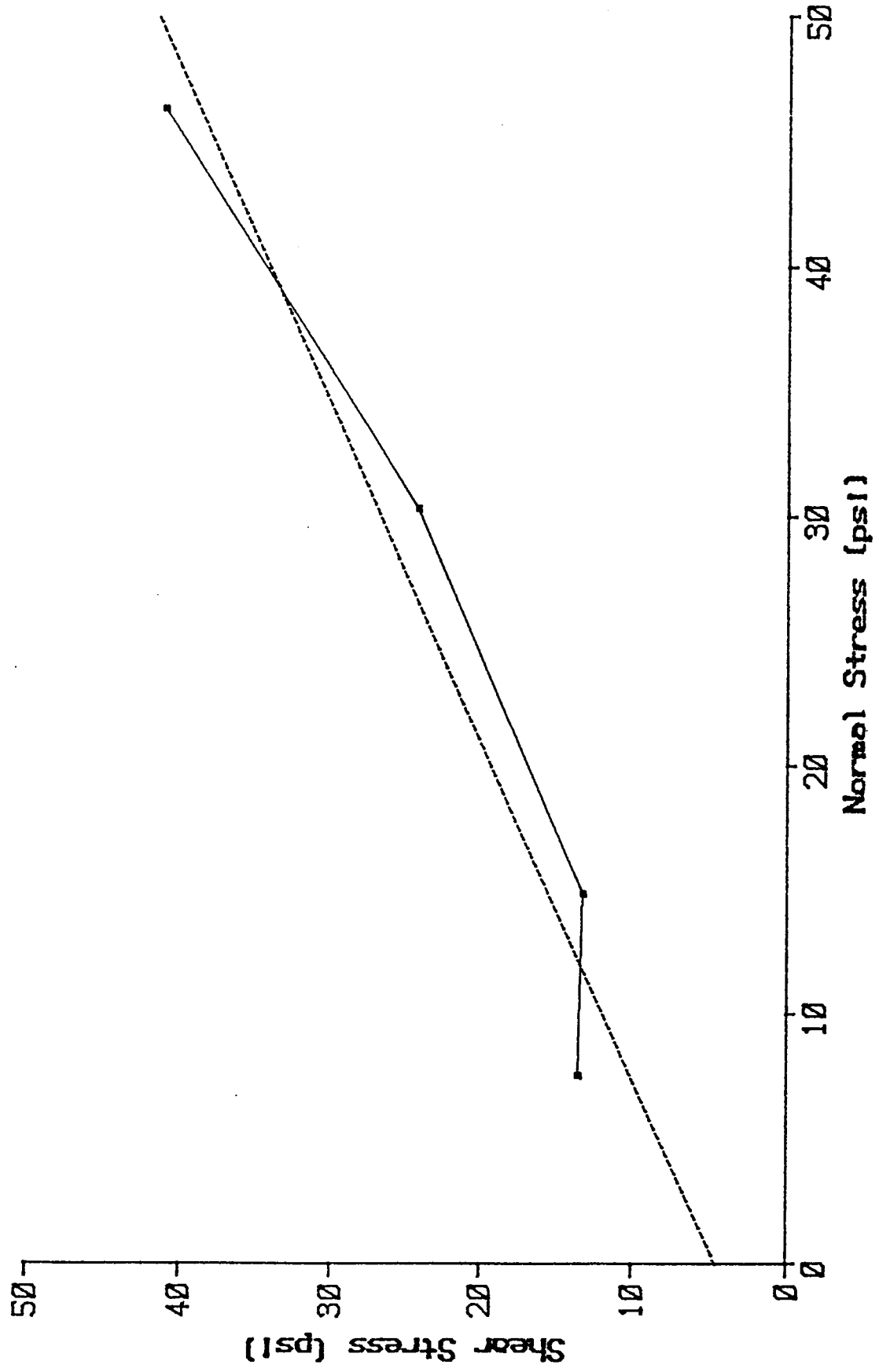
Effective Cohesion	4.5 psi
Angle of Sliding Friction	37 deg.
Mean Shear Stress	23.0 psi
Mean Normal Stress	24.9 psi
Equation of Regression Line	$y = 0.74x + 4.5$
Coefficient of Correlation	0.97
Coefficient of Determination	0.95

Power Data

Coefficient k	2.98
Exponent m	0.64

Run-No.	Shear Stress	Normal Stress
1	13.20882	14.88014
2	24.2232	30.4416
3	41.10921	46.44147
4	13.50763	7.955416

# Waste Dump



# AREA DATA & LOAD CALCULATIONS

Job: Mercur  
 Location: UT  
 Sample Number: Waste Dump

Initial Area: 7138.06 SQ. IN.  
 Date: 8/25/86  
 By: Armstrong

SAMPLE WIDTH	SAMPLE LENGTH	AREA IN SQ. INCHES
11.75	11.75	138.

Normal Stress (psi)	Area (insq)	Load on Sample (lbs) Cal.	PSIG App.
6.94	7138.06	958	200
13.89	7138.06	1918	475
27.78	7138.06	3835	950
41.67	7138.06	5753	1425